

Intermediate Tracker Preliminary Estimates

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Tracking Set Up

- Modifications were made to `G4_Svtx_maps+tpc` by adding a 4th layer
- IT tracker radius used was either 10 or 18 cm
- IT tracker thickness was 0, 1, 2, 3, or 4%
- IT tracker length was 50 cm
- The IT layer had the same cell size as the maps layers (20 by 20 microns)

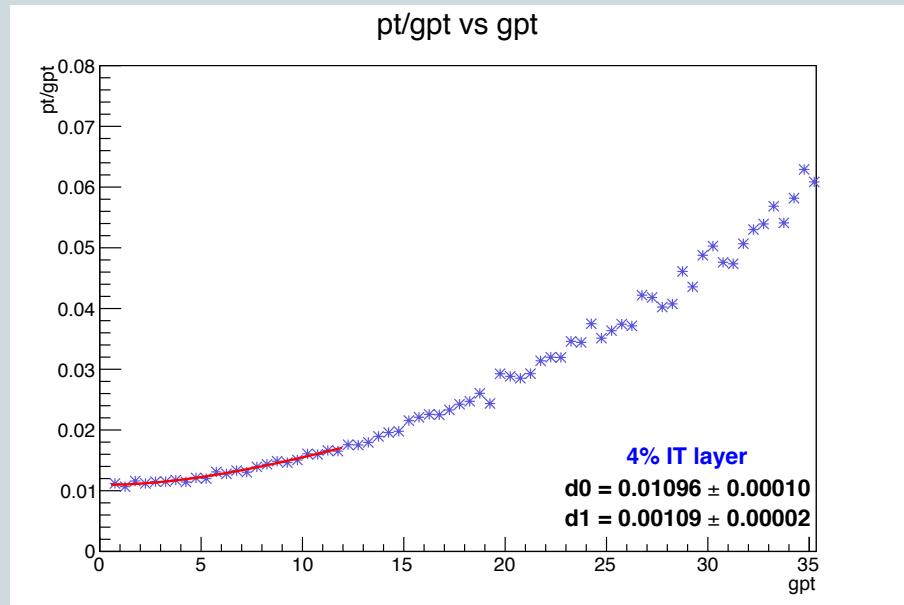
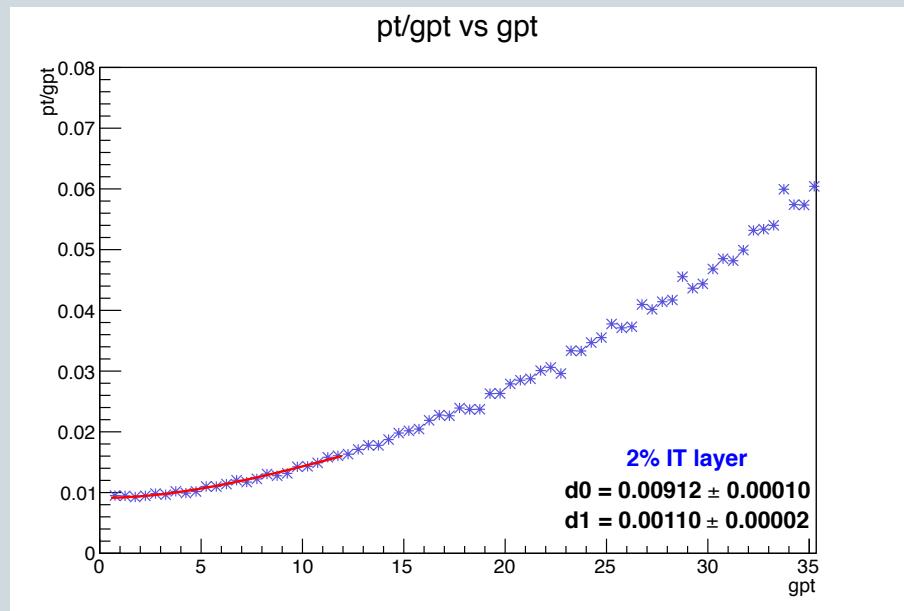
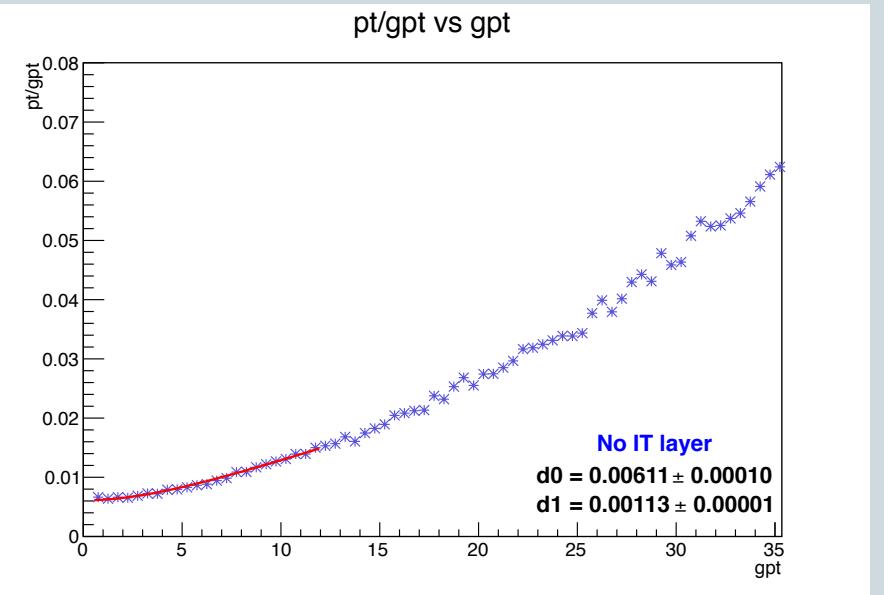
Assumptions/Background

- Intermediate tracker layer material used in analysis is a **single layer of copper**
- Intermediate tracker has a **single layer of active silicon** with 20 micron by 20 micron pixel size
- We will compare results of 1%, 2%, 3% and 4% IT thickness layer with no IT layer results

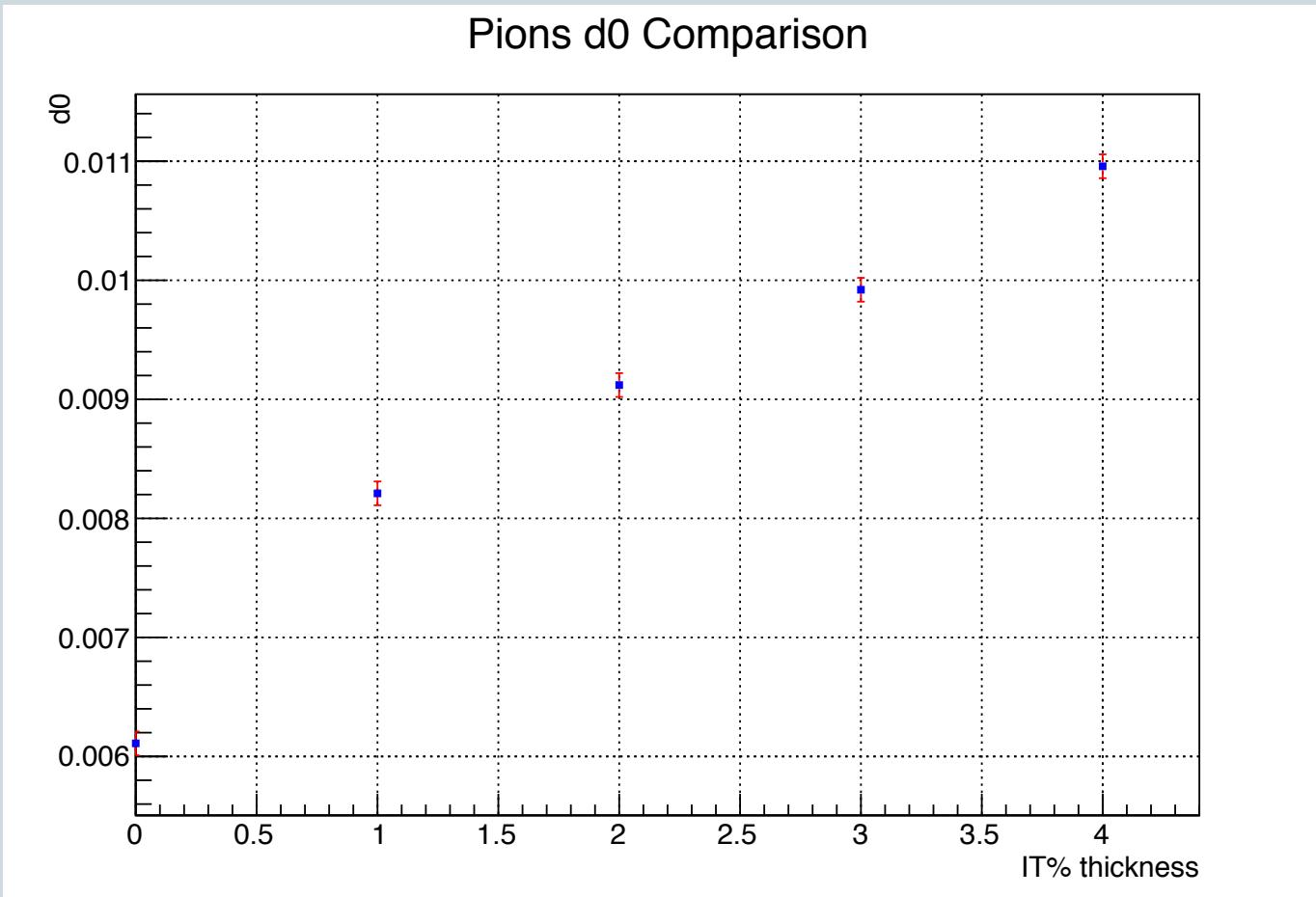
Pion Simulation

- Threw 80 pions per event in the momentum range $0.5 - 40.0 \text{ GeV}/c^2$
- Ran 100,000 events
- IT layer radius used: 18.0 cm
- Vertex distribution width $(0.0, 0.0, 5.0)$

Pion Results



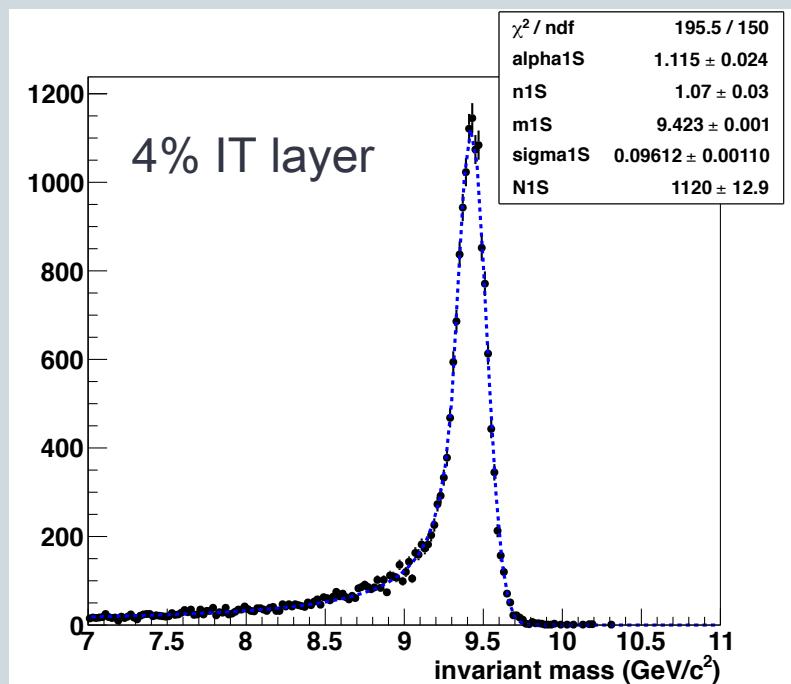
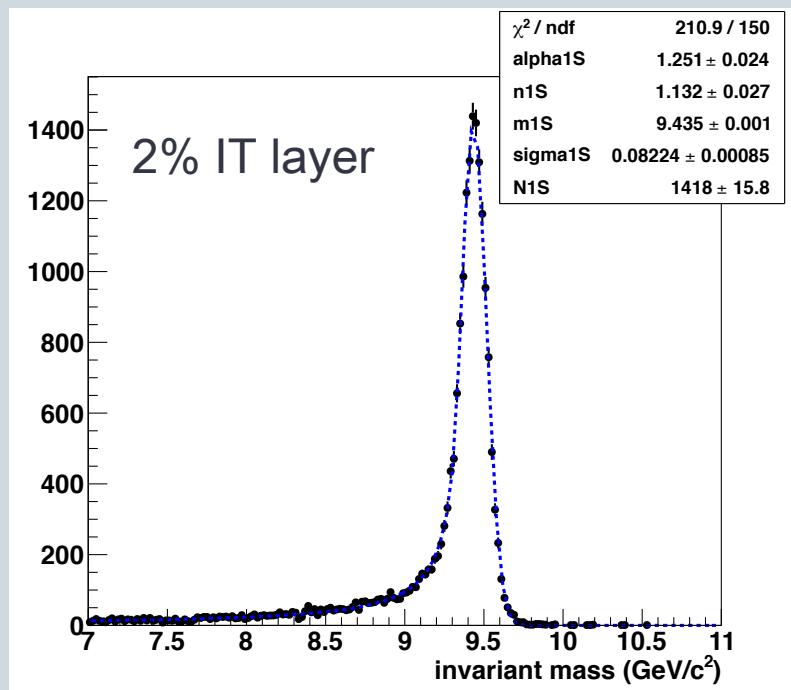
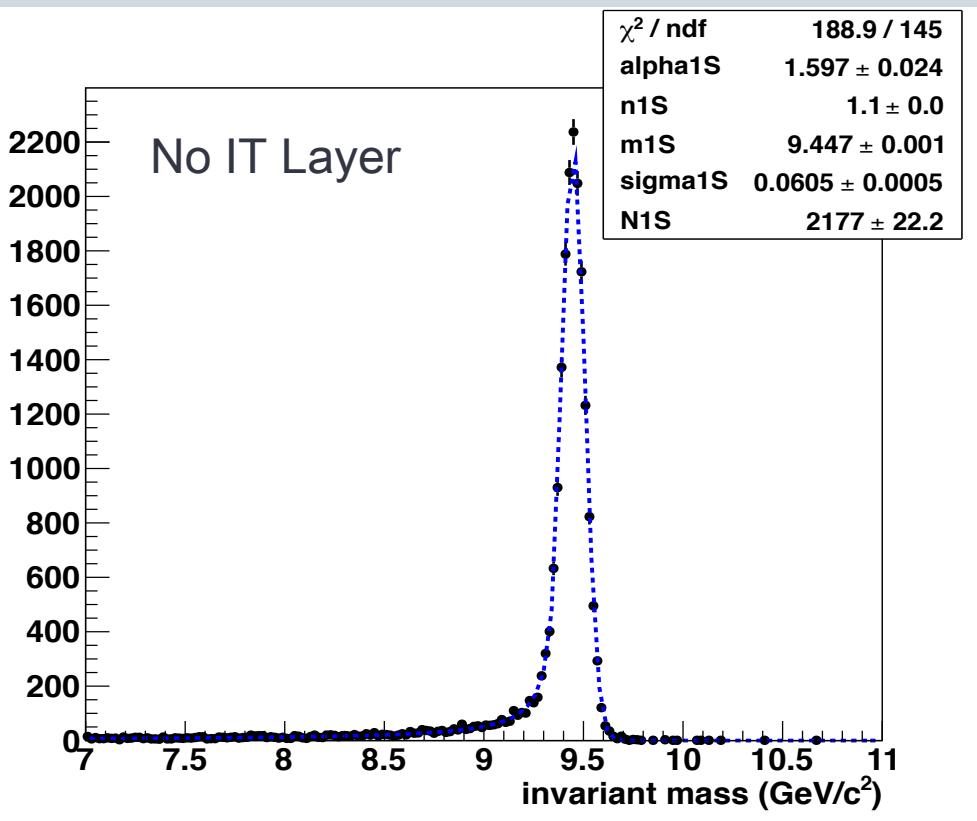
Comparison, Pions



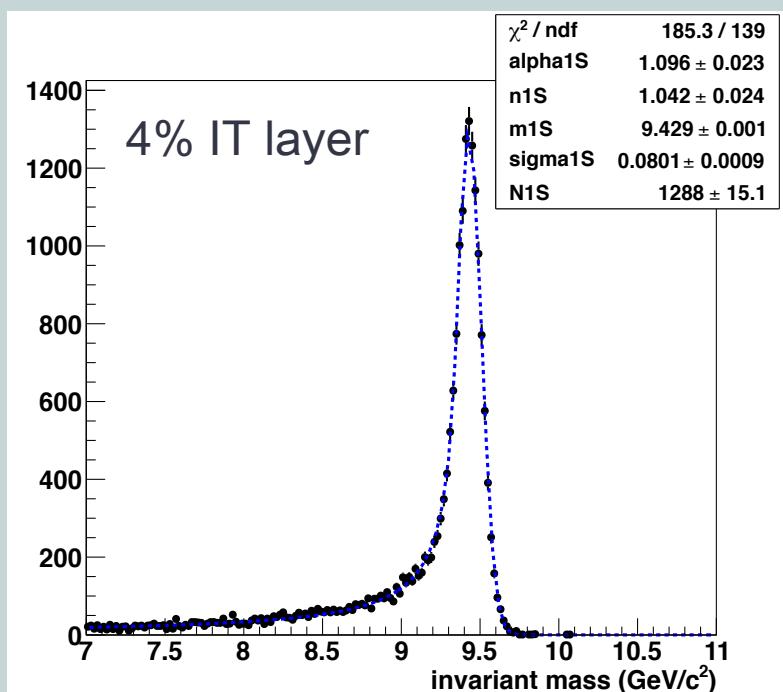
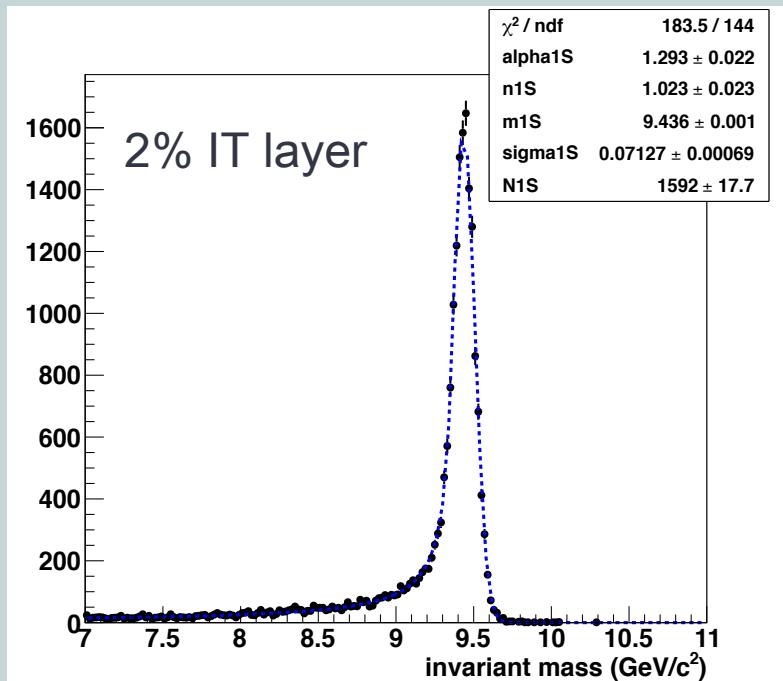
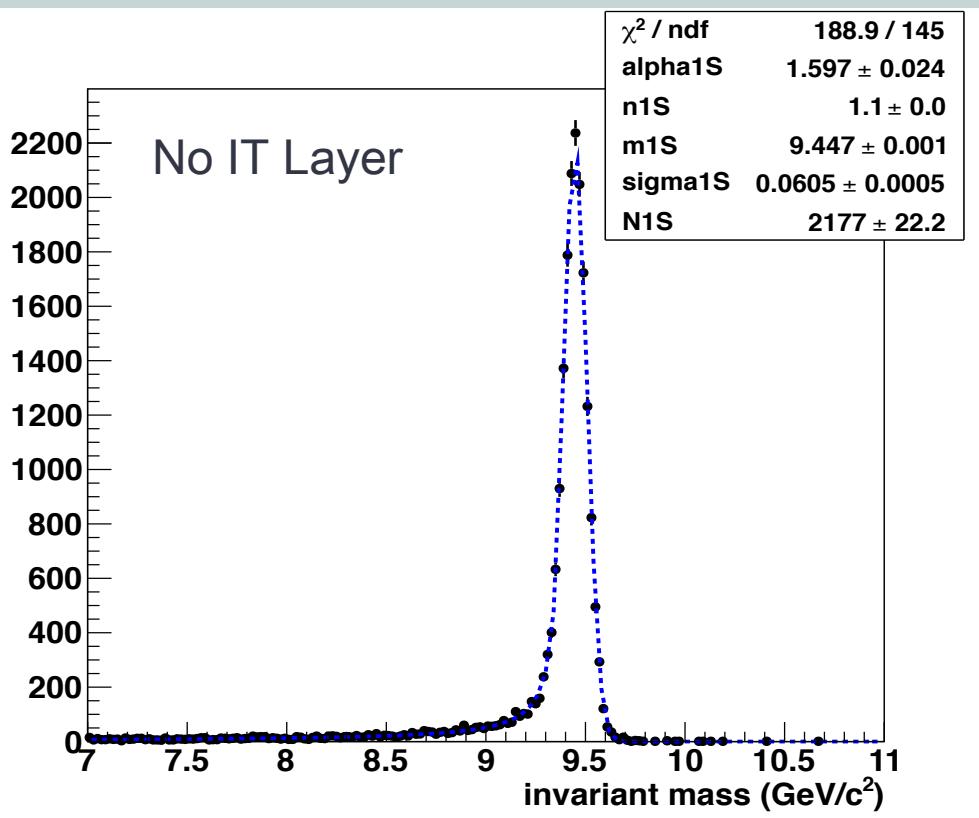
Upsilon Simulation

- Threw 1 upsilon per event
- Ran 100,000 events
- IT layer radius used: 18 cm, then 10 cm
- Vertex distribution (0.0, 0.0, 0.0)

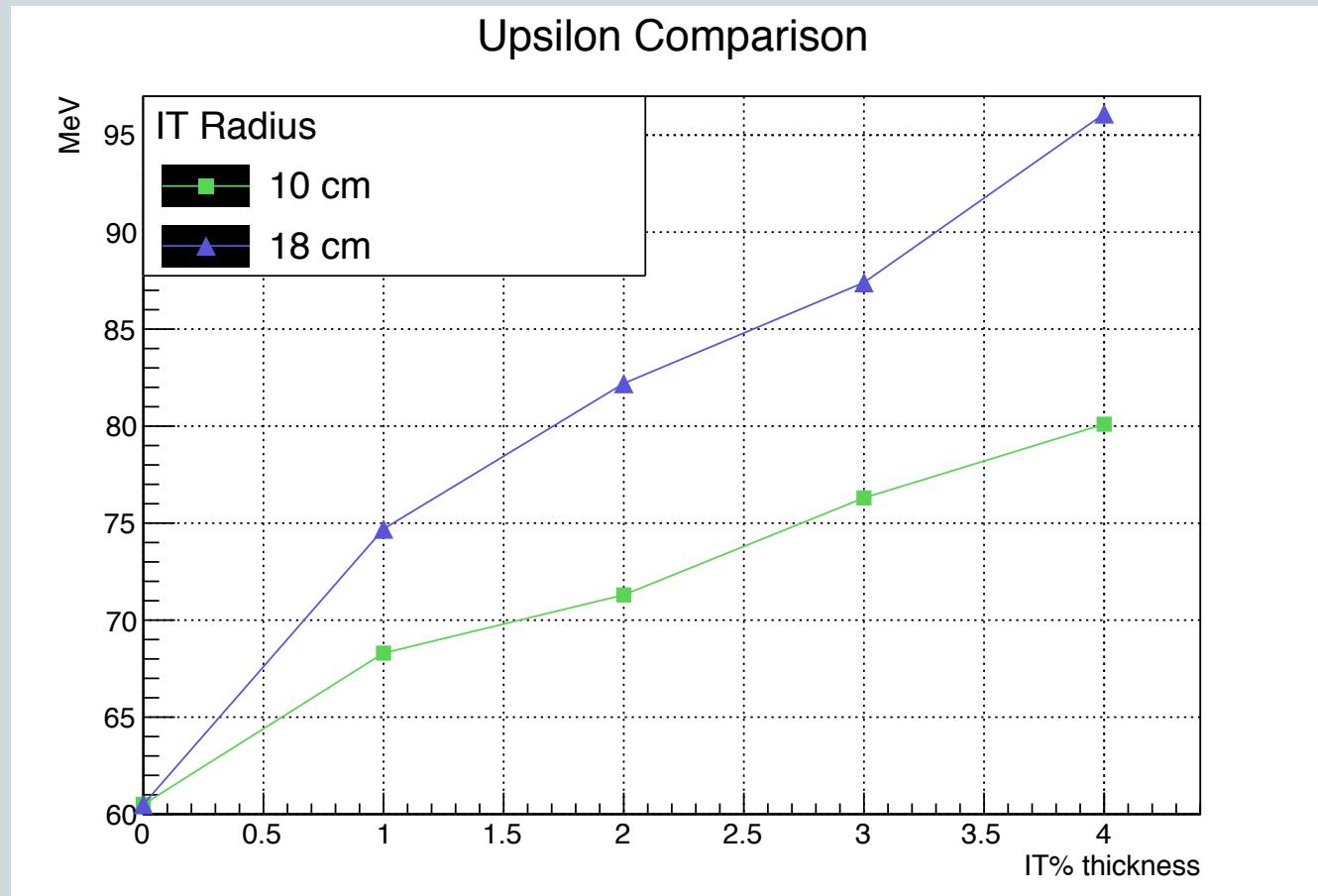
Upsilon Results, 18 cm



Upsilon Results, 10 cm



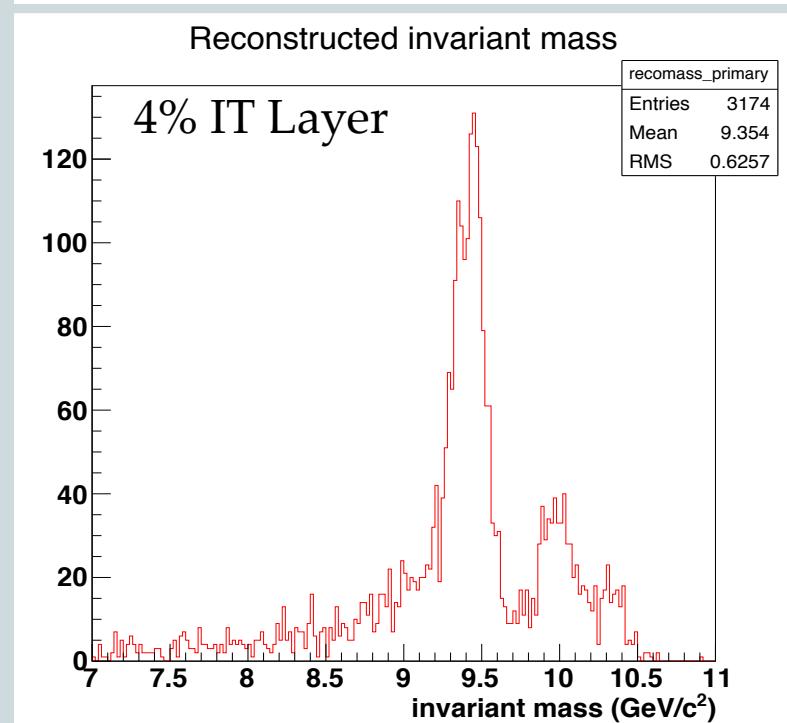
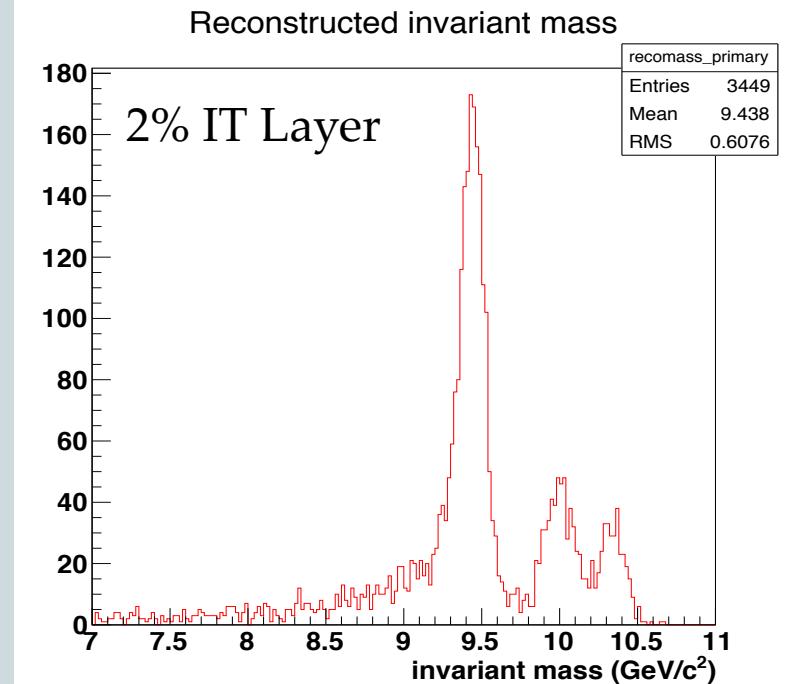
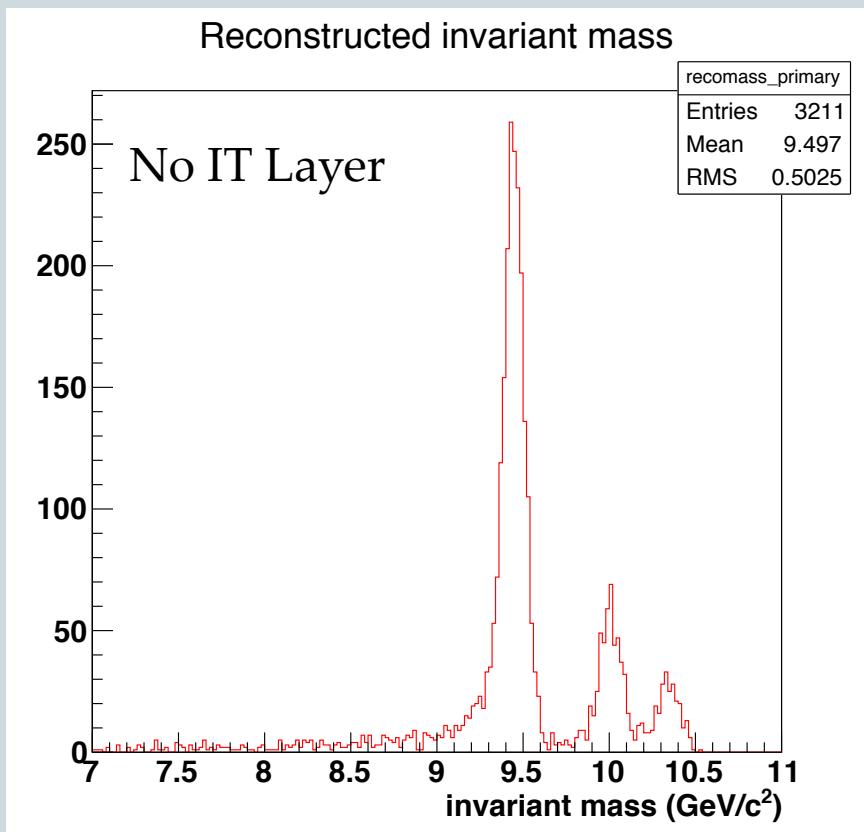
Comparison, Upsilons



Upsilon 1s, 2s, 3s Simulation

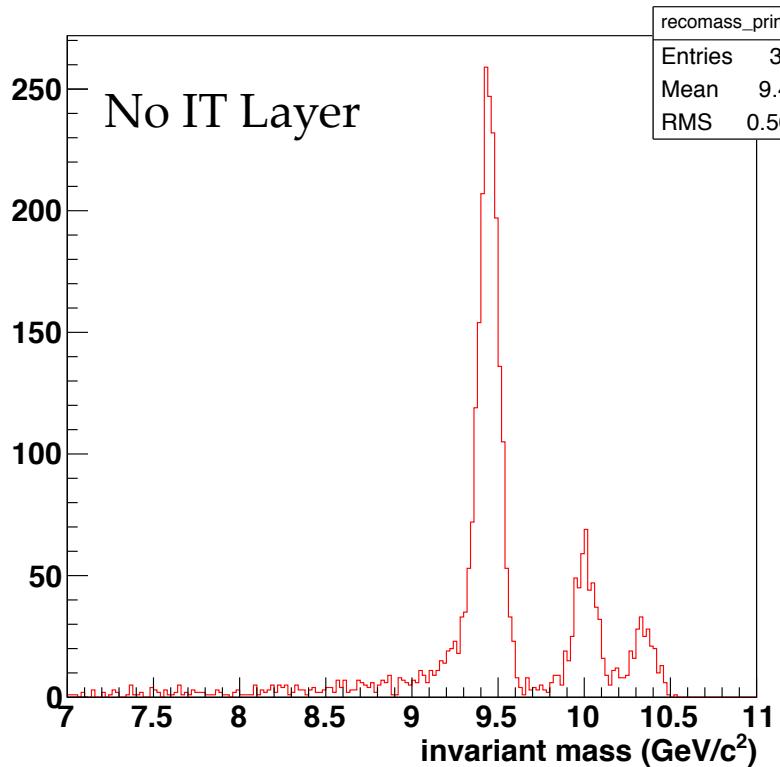
- Threw 1 upsilon in the 1s state per event
- Ran 5625 events $\sim Y(1s)$
- Repeated with 2s and 3s states
- Ran 1415 events $\sim Y(2s)$
- Ran 740 events $\sim Y(3s)$
- No IT layer, 2% or 4% IT layer
- 10 cm or 18 cm

Upsilon 1s, 2s, 3s 18 cm

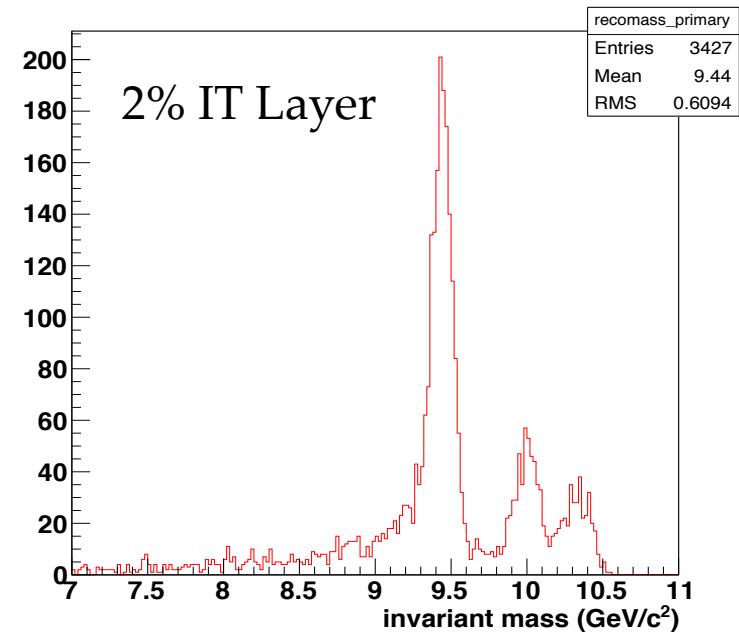


Upsilon 1s, 2s, 3s 10 cm

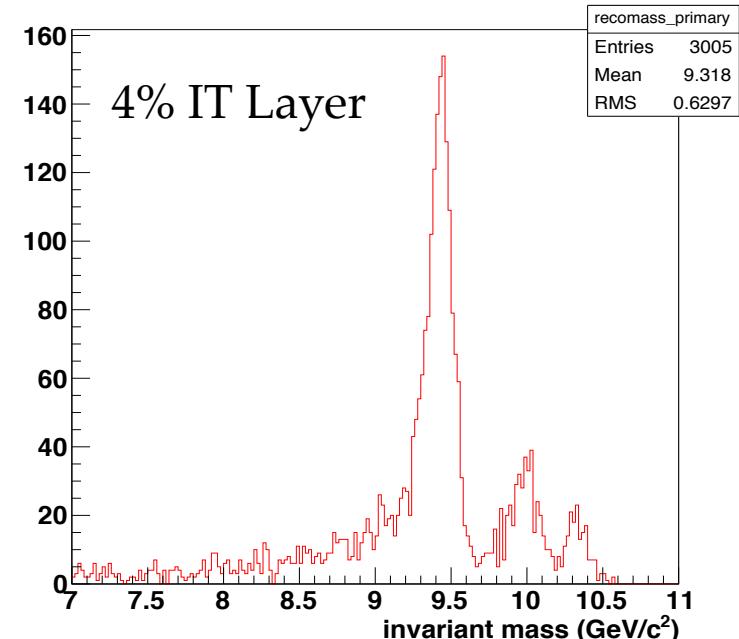
Reconstructed invariant mass



Reconstructed invariant mass



Reconstructed invariant mass



Conclusions

- Adding Intermediate Tracking layer significantly worsens mass resolution
- The smaller the radius, the smaller the effect on mass resolution
- At 2% radiation length, the upsilon mass resolution worsens from 60.5 MeV to 71.3 MeV (10 cm) or 82.2 MeV (18 cm)
- At 4% radiation length, the upsilon mass resolution worsens to 80.1 MeV (10 cm) or 96.1 MeV (18 cm)